POSTEMBRYONIC GROWTH CHANGES IN THE ISOPOD PENTIDOTEA RESECATA (STIMPSON) WITH REMARKS ON THEIR TAXONOMIC SIGNIFICANCE

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Introduction

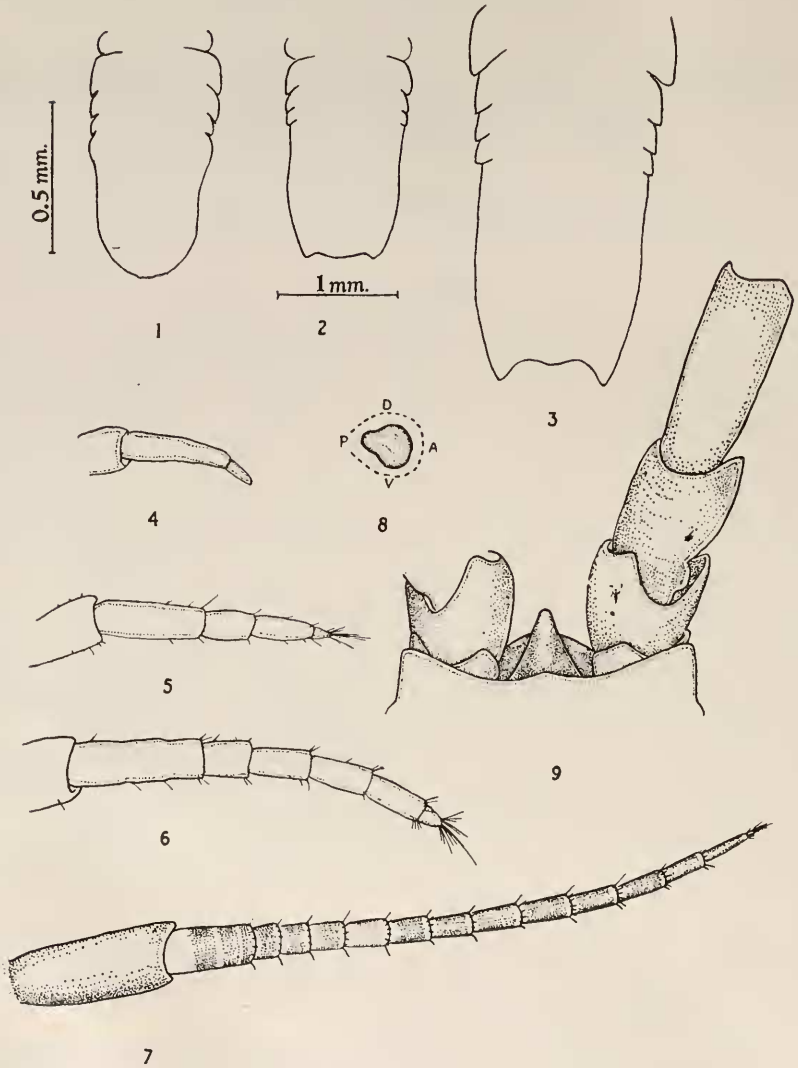
This study was the result of the observation that the number of setae of the seventh peraeopod of *Pentidotea resecata* (Stimpson) (Valvifera: Idotheidae) was markedly variable. It was decided to conduct an investigation including features other than peraeopod setal number, in order to determine which features remained relatively stable and were thus of specific significance in the classification of the marine idotheids. The nature of the variations in certain features was found to be directly related to the size of the specimens, and thus to growth; and it is believed that these variations are of basic significance to isopod taxonomy. The features at present used to distinguish marine isopods of North America of the family Idotheidae include the number of segments of the flagellum of the second antennae, the number of segments of the palp of the maxilliped, and the shape of the posterior margin of the telson (Richardson, 1905 and references, pp. 346–408). It is most significant that, in the species investigated, it was these features that demonstrated the greatest degree of growth variation.

The material consisted of ten adult and seven juvenile specimens which ranged in length from 5.2 mm. to 43.0 mm. and of ten far advanced embryos of 2.2 mm. length, removed from the marsupium of an adult female of the species. The specimens were collected by the writers during the summer of 1947 from eelgrass, *Zostera* sp., located on the sand flats of Tomales Bay, Marin County, California, where the species is fairly abundant.

The head. The most stable features of the head during growth included the shape and location of the eyes (Fig. 8) and also the relationship of the frontal laminae to one another and to the anterior-dorsal border of the head. In embryos, however, these features were not developed.

The number of segments to the flagellum of the second antennae was found to increase in direct proportion to the size of the specimen at least until adult status was reached. This phenomenon was observed in part by Hale (1946, Fig. 19, p. 193) in his description of *Antarcturus horridus* Tattersall (Arcturidae). Embryos 2.2 mm. long had two segments to the flagellum of the second antenna. In a specimen of 5.2 mm. and one of 6.0 mm. length the number of segments was four. In two specimens of 8 mm. length, one of 9 mm. length and in one specimen of 10 mm. length the number of segments was seven; while in one specimen of 9.5 mm. length the number of segments was eight. Even among the larger specimens the number of segments of the flagellum was observed to vary considerably. The length of the flagellum appears to be proportional to the body length in the juvenile

PLATE I



Pentidotea resecata

FIGURE 1. Abdomen, dorsal view, embryo, 2.2 mm. length. Magnification as indicated.
FIGURE 2. Abdomen, dorsal view, juvenile, 5.2 mm. length. Magnification as indicated.
FIGURE 3. Abdomen, dorsal view, small adult male, 9.5 mm. length. Magnification as per Figure 2.
FIGURE 4. Flagellum second antenna, left, embryo, 2.2 mm. length. Magnification as per Figure 1.
FIGURE 5. Flagellum second antenna, left, juvenile, 5.2 mm. length. Magnification as per Figure 1.
FIGURE 6. Flagellum second antenna, left, small adult male, 9.5 mm. length. Magnification as per Figure 1.

specimens of *P. resecata,* while in the adult specimens the length of the flagellum varied.

In specimens of 6.5 mm. and below, the palp of the maxilliped was four jointed. More developed specimens had a maxilliped palp of five segments. At present the only character used to distinguish the genus *Pentidotea* (Richardson, 1905, p. 368) from *Idothea* (ibid., p. 356) is the presence of a five-jointed palp in the former and of a four-jointed palp in the latter (see also Light, 1941, p. 87). It seems evident to the writers that either *Pentidotea* must be considered a synonym of *Idothea* or that the generic differences must be redefined.

The increase in setae on the tip of the endopodite of the maxilliped was found to be correlated directly with the size of the specimen (compare Fig. 17 and Fig. 19). The same was true of the "hairiness" of the median border of the palp of the maxilliped. Only the presence of a single coupling-hook on the median border of each maxilliped was found to be constant (Figs. 17 and 19, "x").

The perion. The relationship in length of the lateral border of the epimeral segments of the perion to the length of the lateral border of the perion segments themselves appeared to be constant, yet measurements made at the second and third perion segments showed considerable variation. This variation did not correlate directly with a size increase of the specimens and the writers believe that the difficulty in obtaining accurate measurements of these structures accounts for the irregularity. Observations indicate that the seventh perion segment remained in an undeveloped state in juvenile animals as large as 5.2 mm. Its retarded development was best indicated on embryo specimens. The general narrow shape of the animal was maintained in animals of all sizes. Ovigerous specimens showed a distinct lateral widening of the segments of the perion concerned with the marsupium development.

The peraeopod. The number of setae on the seventh peraeopod was examined carefully in the hope that a very definite non-variable structural feature could be found. The number of setae on the ventral surface of the propodus was observed to be directly proportional to the size of the animal. Three distinct types of setae are discernible; a "saw-toothed" seta (Fig. 11), a "file-toothed" seta (Fig. 10), and a "simple" seta (Fig. 12). A once specialized seta observed on the propodus of the seventh peraeopod of a small animal was always found without modification, other than increase in size, on the propodus of the seventh peraeopod of a larger animal. The "saw-toothed" type seta was constant in number and location. The "file-toothed" type seta was more numerous on the propodus of the seventh peraeopod of larger specimens and the same is true of the "simple" type setae which most frequently surrounded the "file-toothed" seta. Evidence indicates that the "file-toothed" seta is developed, in part at least, from one of the "simple" type.

It was found that the seventh peraeopod was weakly developed in very small specimens (below 6.0 mm. length); whereas the first to the sixth peraeopods were

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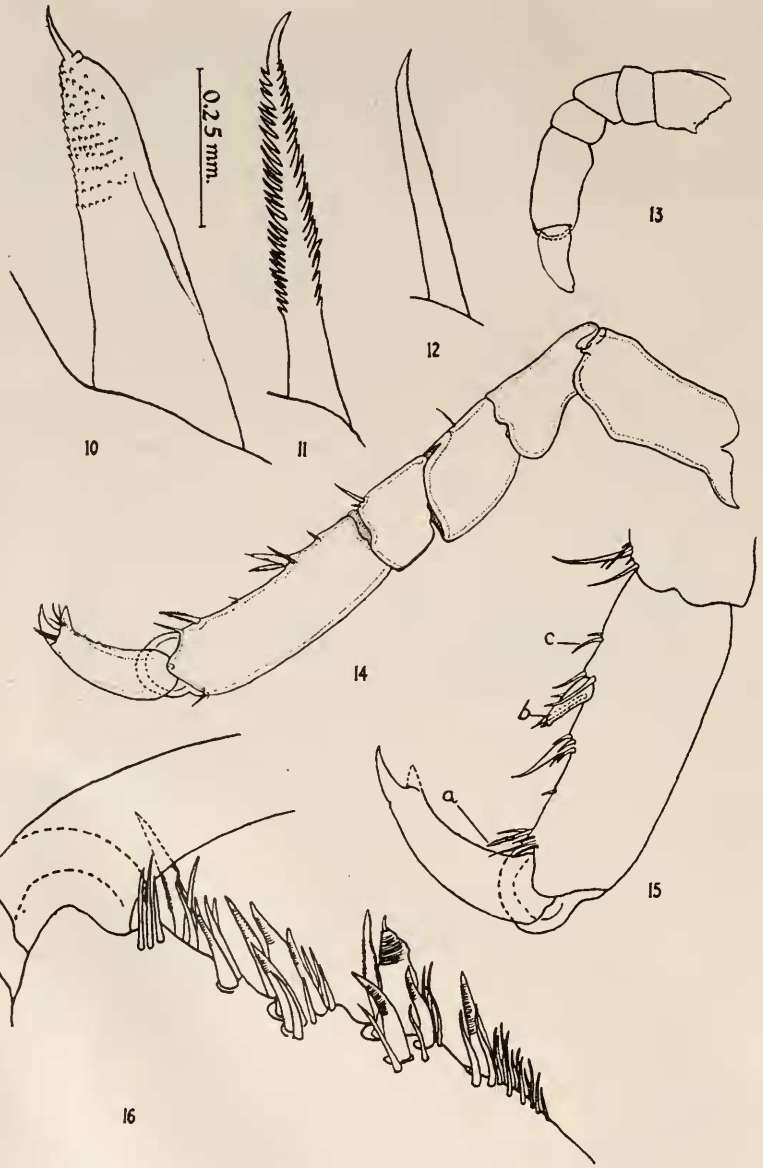
FIGURE 7. Flagellum second antenna, left, adult male, 20.5 mm. length. Magnification as per Figure 2.

FIGURE 8. Eye, left, lateral view, adult male, 20.5 mm. length; "P" posterior, "A" anterior, "D" dorsal, "V" ventral. Magnification as per Figure 2.

FIGURE 9. Anterior-dorsal border and first two frontal laminae, adult male, 20.5 mm. length. Magnification as per Figure 2.

PLATE II



Pentidotea resecata

FIGURE 10. File-toothed seta of ventral surface of propodus, see "b" of Figure 15. Magnification as indicated.

FIGURE 11. Saw-toothed seta of ventral surface of propodus, see "a" of Figure 15. Magnification as per Figure 10.

FIGURE 12. Simple seta of ventral surface of propodus, see "c" of Figure 15. Magnification as per Figure 10.

well developed. The retardation in the development of the seventh peraeopod has been observed in other isopods (Sømme, 1940, Linmoriidae, p. 158; Faxon, 1882, Asellidae, pl. vi, Fig. 19; Hult, 1941, Parasellidae, p. 39).

The telson. The concavity of the posterior margin of the telson has been regarded as the most diagnostic and key feature of this species. Actually, however, the margin was found by the writers to change very gradually from one with a convex posterior border in the embryo (Fig. 1) to a slightly concave margin in specimens of 6.5 mm. in length (Fig. 2); until, when the adult condition is reached (Fig. 20), the concavity is most developed.

The uropod conforms to the shape of the telson and therefore varies in accordance with its size and shape. The number of movable setae at the lateral articular distal border of the penultimate uropod segment varied in number from one to two regardless of size or sex of the specimen.

It is evident from the above observations that very young specimens of *Pentidotea resecata* might very well be placed in the genus *Idothea* and considered new to science by an investigator unaware of the developmental nature of the maxilliped palp. Such would be true at least as long as the two genera *Idothea* and *Pentidotea* remain so briefly designated. Indeed one writer, Fee (1926, p. 18, Fig. 12) did just that in describing *Idothea rufescens* from specimens which apparently are juvenile specimens of *Pentidotea resecata* (Stimpson).

The suggestion of course from the above is that authors of new species of Idotheid genera (as well as isopods in general) not only indicate the measurements of the types but also give measurements of all specimens figured or described in the text. To date such a procedure has been followed by only a very limited number of workers and even then without any marked degree of consistency.

Summary

In an attempt to find constant characteristics which may be relied upon as specifically diagnostic in the marine isopod *Pentidotea resecata,* the following features proved to be especially significant constant features regardless of the size of the specimen: (1) structural interrelationships of the frontal laminae, (2) epimeral plate length in relation to the length of the lateral border of the corresponding perion segment, (3) the character of the setation and certain features of peraeopod morphology, (4) general body shape.

Features showing numerical increase which was found to be directly proportional to the size of the animal and thus believed to be of very limited taxonomic utility include: (1) number of segments to the flagellum of the second antennae, (2) number of segments to the palp of the maxilliped, (3) number of setae of the maxilliped and of the peraeopods.

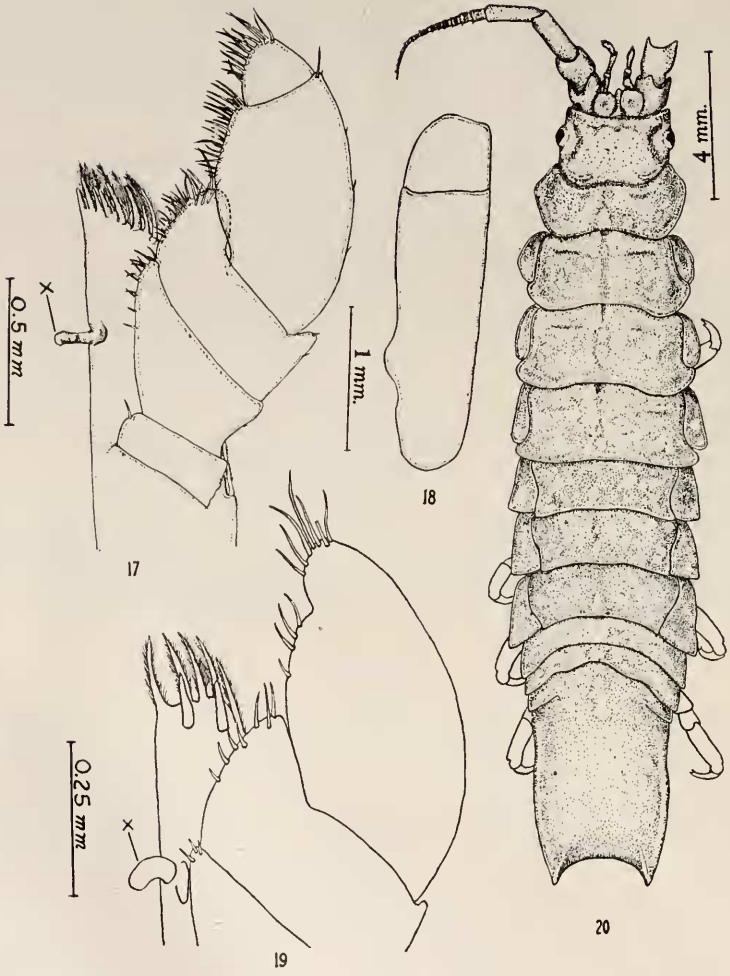
Figure 13. Seventh peraeopod, right, juvenile, below 6.0 mm. length. Magnification as per Figure 1.

Figure 14. Seventh peraeopod, left, juvenile, above 6.0 mm. length. Magnification as per Figure 1.

Figure 15. Propodus and dactylus of seventh peraeopod, small adult male, 9.5 mm. length. Magnification as per Figure 1.

Figure 16. Ventral border of propodus of seventh peraeopod of large adult male, 20.5 mm. length. Magnification as per Figure 1.

PLATE III



Pentidotea resecata

Magnification as indicated

FIGURE 17. Maxilliped, left, small adult male, 9.5 mm. length; "x" is the coupling-hook.
FIGURE 18. Uropod, left, small adult male, 9.5 mm. length.
FIGURE 19. Maxilliped, left, juvenile, 5.2 mm. length; "x" is the coupling-hook.
FIGURE 20. Dorsal view, adult male, 20.5 mm. length.

It would seem to be necessary, in view of the findings, to reexamine the status of species and genera which owe their existence exclusively or in part to characteristics here shown, in this species at least, to be variable in different age groups.

One species *Idothea rufescens* Fee, apparently based on immature specimens, is considered a synonym of *Pentidotea resecata* (Stimpson).

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